CLAIMS

1. An isolated osteocalcin fragment derived from human urine, said fragment characterized in that at least one of the glutamic acids in the position 17, 21 and 24 of the amino acid sequence

6 7
Tyr-Leu-Tyr-Gln-Trp-Leu-Gly-Ala-
Pro-Val-Pro-Tyr-Pro-Asp-Pro-Leu-
17 21 24
Glu-Pro-Arg-Arg-Glu-Val-Cys-Glu-Leu-
30
Asn-Pro-Asp-Cys-Asp-Glu-Leu-Ala-
Asp-His-Ile-Gly-Phe-Gln-Glu-Ala-
Tyr-Arg-Arg-Phe-Tyr-Gly-Pro-Val (SEQ ID NO: 1)

is gamma-carboxylated.

2. The fragment according to claim 1 characterized in that the fragment spans from the amino acid in position 7 to the amino acid in position 30 of the amino acid sequence described in claim 1, and that all three glutamic acids in the positions 17, 21 and 24 of said sequence are gamma-carboxylated.

3. The fragment according to claim 1 characterized in that the fragment spans from the amino acid in position 6 to the amino acid in position 30 of the amino acid sequence described in claim 1, and that all three glutamic acids in the positions 17, 21 and 24 of said sequence are gamma-carboxylated.

4. A monoclonal antibody or recombinant antibody fragment having the capability of binding the human gamma-carboxylated osteocalcin fragment according to claim 1, ~~2 or 3~~, characterized by the specificity to epitopes that have been identified on the gamma-carboxylated fragment of osteocalcin, wherein said fragment spans either

i) from the amino acid in position 7 to the amino acid in position 30, or

ii) from the amino acid in position 6 to the amino acid in position 30

of the amino acid sequence described in claim 1, and that all three glutamic acids in the positions 17, 21 and 24 of said sequence are gamma-carboxylated.

5. A cell line producing the monoclonal antibody according to claim 4.

6. A non-competitive immunoassay for quantitative determination of a gamma-carboxylated osteocalcin fragment according to claim 1 characterized in that a sample containing said fragment is exposed to two monoclonal antibodies or recombinant antibody fragments which bind said gamma-carboxylated osteocalcin fragment.

7. The immunoassay according to claim 6 characterized by employing monoclonal antibodies or recombinant antibody fragments specific to epitopes that have been identified on the gamma-carboxylated fragment of osteocalcin, wherein said fragment spans either

i) from the amino acid in position 7 to the amino acid in position 30, or

ii) from the amino acid in position 6 to the amino acid in position 30

of the amino acid sequence described in ~~claim 1~~ SEQ ID NO:1, and that all three glutamic acids in the positions 17, 21 and 24 of said sequence are gamma-carboxylated.

8. The immunoassay according to claim 6 ~~or 7~~ characterized in that the non-competitive immunoassay is carried out in either a one-step or a two-step incubation procedure.

9. The immunoassay according to claim 6 ~~or 7~~ characterized in that the two monoclonal antibodies employed are the antibodies 2H9 and 6F9 that recognize the C-terminal and N-terminal epitopes on the fragment which was determined to be 3005.

10. The immunoassay according to claim 6 ~~or 7~~ characterized in that the two monoclonal antibodies employed are the antibodies 6F9 and 1C4 that recognize the N-terminal and the C-terminal epitopes on the measured osteocalcin fragments (6-30 or 7-30).

11. The immunoassay according to claim 6 ~~or 7~~ characterized in that the two monoclonal antibodies employed are the antibodies 6F9 and 3H8 that recognize the N-terminal and the C-terminal epitopes on the measured osteocalcin fragments (6-30 or 7-30).

12. A method for the measurement of the rate of bone turnover (formation and/or resorption) and/or for the investigation of metabolic bone disorders in an individual, characterized by quantitative determination of a fragment according to ~~any of the~~ claim 1 ~~claims 1 to 3~~.

13. The method according to claim 12 characterized in that an immunoassay according to any of the claims 6 - 11 is employed.